

## VCO FEEDBACK LOOP TO REDUCE PHASE NOISE

ABSTRACT

A phase adjustment module in a voltage controlled oscillator (VCO) samples a VCO oscillation to detect changes in the oscillation frequency and produces a corresponding correction voltage that is feedback to the VCO input to correct the frequency change. A plurality of sampling modules, each formed to start sampling at a different point on the oscillation cycle, charge a sampling module capacitor over the period of a full oscillation cycle. The samples are coupled to a low pass filter to produce a running average of all the samples. The charge on each capacitor is coupled to a first input of a plurality of operational amplifiers and the running average is coupled to a second input. The summed output of the operational amplifiers is substantially equal to a difference between the running average and a voltage representing the instantaneous time change or phase change of the oscillation frequency.